Oxygen Reserve Index (ORI): Validation of a new variable

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Background: Monitoring a patient's oxygen status during anaesthesia using pulse oximetry is essential. However, pulse oximetry is limited in the normoxic and hyperoxic range, when oxygen saturation is >97%. In this range, the new Oxygen Reserve Index (ORI), a relative indicator of the partial pressure of oxygen in arterial blood (PaO_2) in the range of 100 to 200 mmHg, may serve clinicians as an early warning of an impending hypoxic state.[1]

Methods: 20 healthy volunteers (age 24±6 yr, BMI 24±3 kg m^{-2}) were breathing via a tight fitting facemask standardized oxygen concentrations ranging from mild hypoxia (FiO_2 0.14) to hyperoxia (FiO_2 1.0) (fig. 1, 2). ORI was measured noninvasively by multiwave pulse co-oximetry (Rainbow SET, Masimo Corp.) to differentiate between normoxic and hyperoxic states by scaling the measured absorption information between 0.00 and 1.00. These ORI values were compared with PaO_2 values obtained from repeated arterial blood samples. In this preliminary analysis, we examined the correlation between changes in ORI (ΔORI) and PaO_2 (ΔPaO_2). Furthermore, we performed regression analysis to compare absolute ORI and PaO_2 values as well as ΔORI and ΔPaO_2 values, respectively.

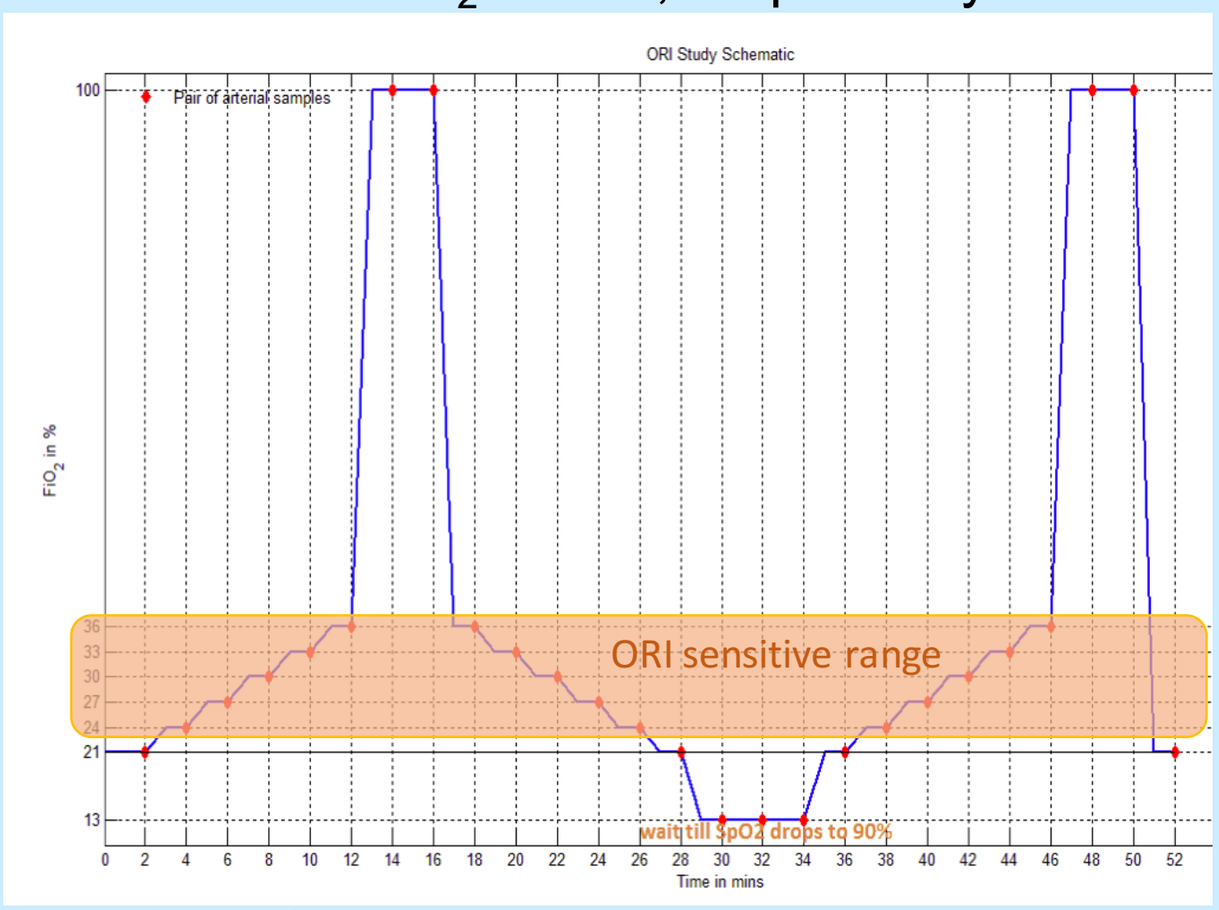

Fig. 1 Study flow chart

Results: Sensitivity and specificity as well as concordance of ΔORI vs. ΔPaO_2 were high (mostly above 90%, for details see table 1). Absolute ORI and PaO_2 values were positively correlated (r^2=0.63; p<0.001, fig. 3A). The same holds true for ΔORI and ΔPaO_2 values (r^2 = 0.59; p<0.001, fig. 3B).

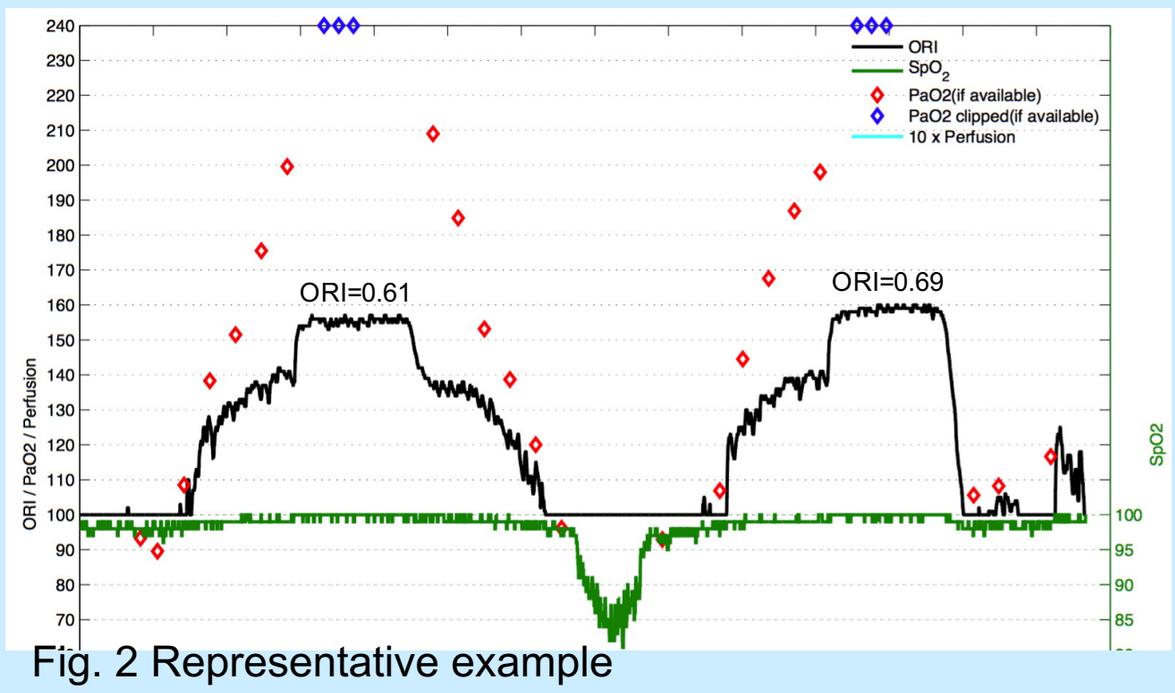

Fig. 2 Representative example

Table 1 Sensitivity/Specificity and Concordance for ΔORI vs. ΔPaO_2

PaO_2 ref (mmHg)	Samples [n]	Sensitivity	Specificity	Concordance
110	710	80.85	99.25	98.03
120	892	95.92	91.24	92.26
130	941	91.61	92.85	92.45
140	1029	92.98	93.19	93.10
150	1047	95.82	91.35	93.70
160	1071	94.84	89.35	92.62
170	1088	94.60	90.89	93.29
180	1028	94.84	90.03	93.39
190	1035	94.83	85.36	92.27

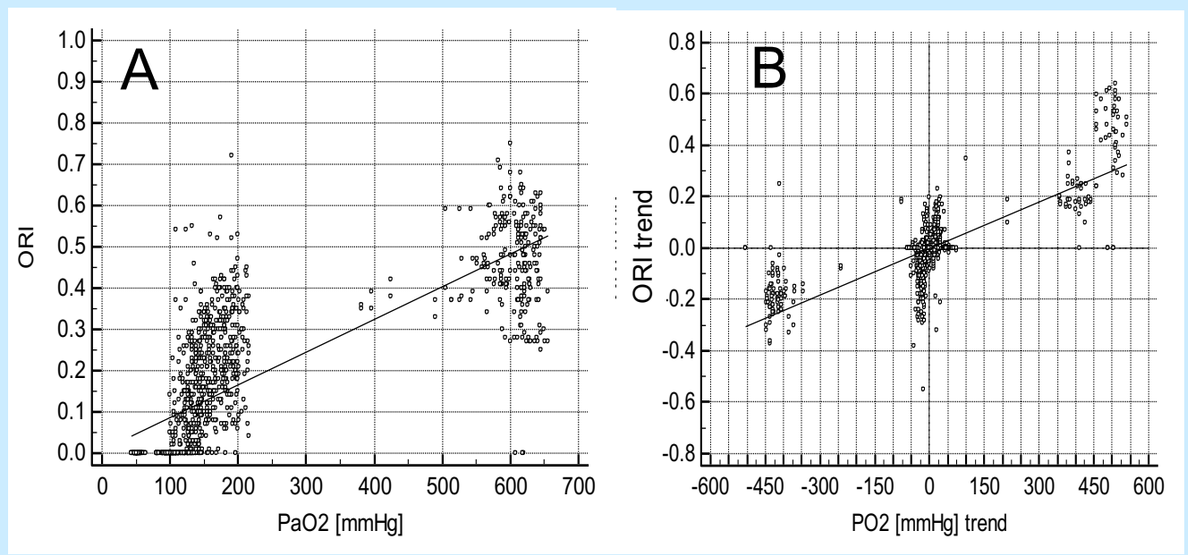

Fig. 3 Correlation of absolute values (A) and changes (trend)(B) of ORI and PaO_2, respectively.

Conclusion: In the flat part of the haemoglobin-oxygen binding curve, where oxygen saturation is >97%, a decrease in ORI indicates a falling PaO_2 prior to oxygen desaturation. As such, the non-invasive and continuously available ORI may offer additional information at maximum SpO_2 values and help guide clinicians in estimating the body's oxygen reserve.

Reference: [1]Szmuk P, et al. Anesthesiology 2016;124:779-86

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